

# **PCH1020**

## **User's Manual**



Beijing ART Technology Development Co., Ltd.

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# Chapter 1 Overview

## 1.1 Introduction

PCH1020 is a 4-axis motion control card which can control 4 axes of either stepper motor or pulse type servo drivers for position, speed, and interpolation controls.

## 1.2 Features






- ✧ PC104+ interface, plug and play
- ✧ 4-axis servo/stepper motor control, each axis can work independently.
- ✧ Pulse Output Frequency Error: <0.1%
- ✧ Maximum Pulse Output Speed: 4 MHz
- ✧ Pulse Output Mode: CP/DIR, CW/CCW
- ✧ Non-symmetrical linear acceleration/deceleration drive, S-shaped acceleration/deceleration
- ✧ Trapezoidal and S-curve velocity profiles
- ✧ Any 2/3 axes linear interpolation, any 2 axes circular interpolation, any 2/3 axes bit pattern interpolation, and continuous interpolation.
- ✧ Constant Speed Driving
- ✧ Start/stop multi-axis simultaneously
- ✧ Control acceleration/deceleration time through programmable
- ✧ Read logic position, physic position, drive speed, acceleration, and acceleration/deceleration status in real-time
- ✧ Each axis has two 32-bit compare register, can be used to software limit
- ✧ Can receive various signals of the servo motor drive, such as hardware limit signal, position signal, the alarm signals
- ✧ 32-bit up/down counter for additional encoder
- ✧ Can connect with step motor, AC or DC servo motor easily
- ✧ Isolation Voltage: 2500Vrms

## 1.3 Specifications


























- ✧ Control Axis 4 axes
- ✧ CPU Data Bit Width: 16 bits






### Interpolation Function

- ✧ 2-axes / 3-axes Linear Interpolation
  - ✚ Interpolation Range Each axis -8,388,607~+8,388,607
  - ✚ Interpolation Speed 1 PPS ~ 4 MPPS
  - ✚ Interpolation Accuracy  $\pm 0.5$  LSB (Within the range of whole interpolation)
- ✧ 2-axes Circular Interpolation
  - ✚ Interpolation Range Each axis -8,388,607~+8,388,607
  - ✚ Interpolation Speed 1 PPS ~ 4 MPPS

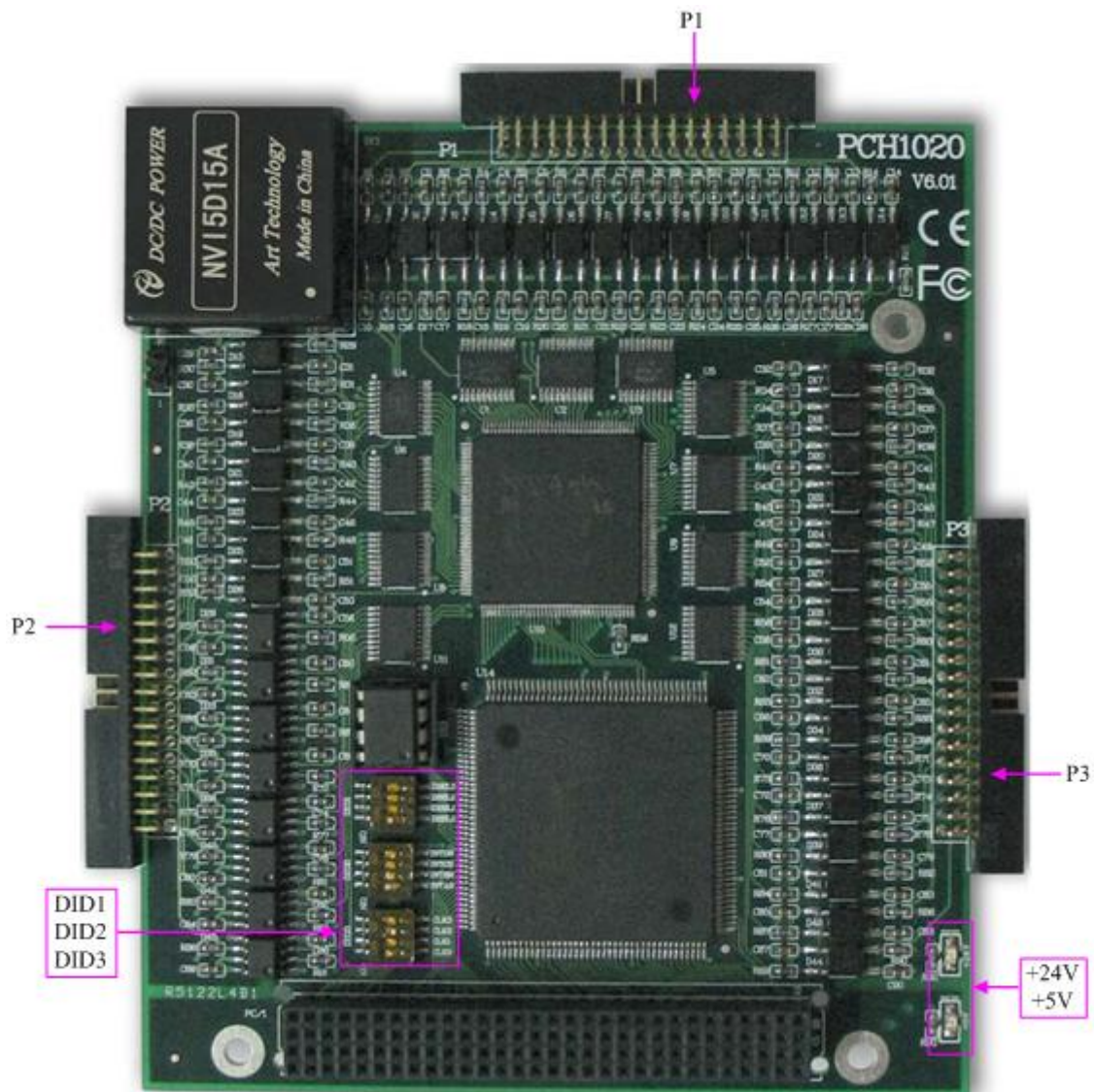
- ✧  Interpolation Accuracy  $\pm 1$  LSB (Within the range of whole interpolation)
- ✧ 2 axes / 3 axes Bit Pattern Interpolation
  -  Interpolation Speed 1PPS ~ 4 MPPS (Dependent on CPU data writing time)
- ✧ Related Functions of Interpolation
  -  Constant vector speed
  -  Continuous interpolation
  -  Step interpolation

### Common Specifications of Each Axis

- ✧ Drive Pulses Output (When CLK = 16 MHz)
  -  ☐ Pulse Output Speed Range 1PPS ~ 4MPPS
  -  Resolution of output speed within  $\pm 0.1\%$
  -  Speed Multiplication: 1~500
  -  S-shaped Jerk:  $954 \sim 31250 \times 10^6$  PPS/SEC<sup>2</sup>
  -  Acceleration/deceleration:  $125 \sim 500 \times 10^6$  PPS/SEC
  -  Initial Speed: 1~8000PPS (Multiple=1)  
500~4\* $10^6$ PPS (Multiple=500)
  -  Drive Speed: 1~8000PPS (Multiple=1)  
500~4\* $10^6$ PPS (Multiple=500)
  -  Output Pulse Number: 0~268,435,455
  -  Speed Curve: constant speed, linear acceleration/deceleration, parabola s-shaped acceleration/deceleration drive
  -  Fixed Drive Deceleration Mode: Auto deceleration and manual deceleration
  -  Output-pulse numbers and drive speeds changeable during the driving
  -  Independent 2-pulse system or 1-pulse direction system selectable
- ✧ Encoder Input
  -  Up/Down pulse style selectable
- ✧ Position Counter
  -  Logic Position Counter (for output pulse t) range  $-2,147,483,648 \sim +2,147,483,647$
  -  Real Position Counter (for feedback pulse) range  $-2,147,483,648 \sim +2,147,483,647$
  -  Data can be read and wrote possible
- ✧ Comparison Register
  -  COMP + Register Position comparison range  $-2,147,483,648 \sim +2,147,483,647$
  -  COMP - Register Position comparison range  $-2,147,483,648 \sim +2,147,483,647$
  -  Status and signal outputs for the comparisons of position counters
  -  Software limit functioned
- ✧ External Signal for Driving
  -  EXPP and EXPM signals for fixed pulse / continuous
- ✧ External Deceleration / Sudden Stop Signal
  -  IN0 ~ 3 4 points for each axis
  -  Enable/disable and logical levels selectable
- ✧ Servo Motor Input Signal
  -  ALARM (Alarm), INPOS (In Position Check)
  -  Enable/disable selectable

- ✧ General Output Signal
  -  IN0 ~ 3 4 points for each axis
  -  OUT0 ~ 7 8 points for each axis
- ✧ Limit Signals Input
  -  2 points, for each + and – side
  -  When it is active, and decelerating/sudden stop selectable
- ✧ Emergency Stop Signal Input
  -  EMG, 1 point for 4 axes
- ✧ Operation Temperature: 0~+50°C
- ✧ Power Supply: 24V (external)
- ✧ Clock: 16.000MHZ
- ✧ Board Dimension: 115mm (L) \* 98mm (W) \* 16mm (H)

## Chapter2 Component Layout



### 2.1 Input/Output Connector

P1, P2: signal input/output connector

P4: general-purpose signal connector

### 2.2 Status Light

+24V: +24V power indicator, on for normal.

+5V: +5V power indicator, on for normal. When connected to the computer properly, the light should be ON.

## 2.2.3 DIP Switch

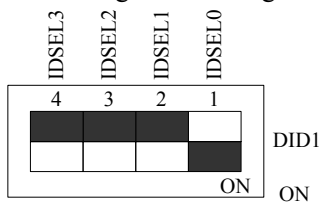
DID1: set the board ID and physical layers, switch No. 1, 2, 3, 4, 5, 6 correspond to ID0, ID1, ID2, ID3, ID4, ID5.

DID1 is board layer setting, when install multiple PC104+ boards, the board is inserted in the PC104+ interface is the bottom board, the layer number is 0, the boards up from the bottom to the up, the layer number is 1,2,3. The switch No. 1, 2, 3, 4, corresponds to IDSELN0, IDSELN1, IDSELN2, and IDSELN3, representing 0, 1, 2, 3-layer.

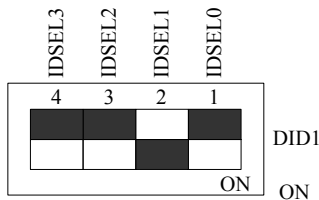
DID2: set the card interrupt, the switch No. 1, 2, 3, 4, corresponds to INTAN, INTBN, INTCN, INTDN, representing the interrupt signal of the 0, 1, 2, 3-layer.

DID3: set the card clock, the switch No. 1, 2, 3, 4, corresponds to CLK0, CLK1, CLK2, CLK3, representing the clock signal of the 0, 1, 2, 3-layer.

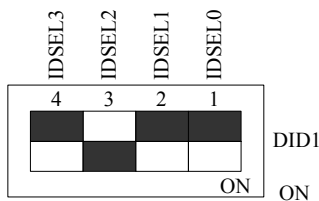
The setting as following:



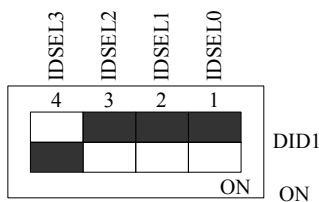
The figure indicates "0001", the layer number is 0



The figure indicates "0010", the layer number is 1



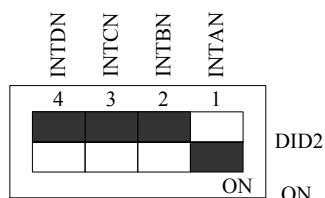
The figure indicates "0100", the layer number is 2



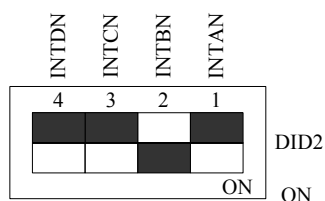
The figure indicates "1000", the layer number is 3

The table is the DID1 setting

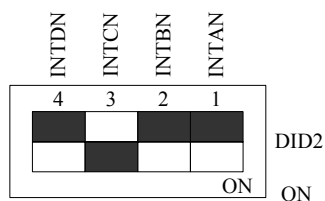
IDSEL3	IDSEL2	IDSEL1	IDSEL0	Layer Number (Hex)
OFF (0)	OFF (0)	OFF (0)	ON (1)	0
OFF (0)	OFF (0)	ON (1)	OFF (0)	1
OFF (0)	ON (1)	OFF (0)	OFF (0)	2
ON (1)	OFF (0)	OFF (0)	OFF (0)	3



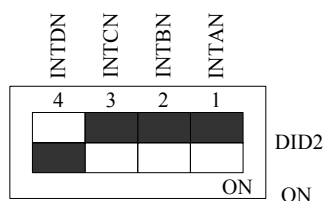
The figure indicates "0001", select the interrupt of the 0-layer



The figure indicates "0010", select the interrupt of the 1-layer



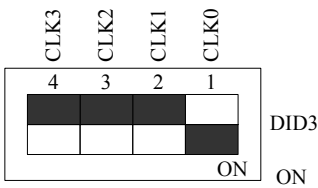
The figure indicates "0100", select the interrupt of the 2-layer



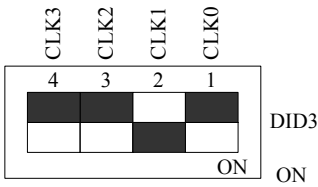
The figure indicates "1000", select the interrupt of the 3-layer

The table is the DID2 setting

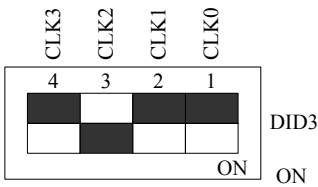
INTDN	INTCN	INTBN	INTAN	Interrupt ID of the layer (Hex)
OFF (0)	OFF (0)	OFF (0)	ON (1)	0
OFF (0)	OFF (0)	ON (1)	OFF (0)	1
OFF (0)	ON (1)	OFF (0)	OFF (0)	2
ON (1)	OFF (0)	OFF (0)	OFF (0)	3



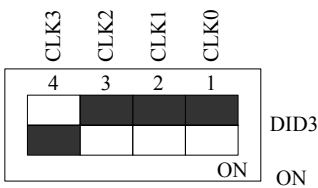
The figure indicates "0001", select the clock of the 0-layer



The figure indicates "0010", select the clock of the 1-layer



The figure indicates "0100", select the clock of the 2-layer



The figure indicates "1000", select the clock of the 3-layer

The table is the DID3 setting

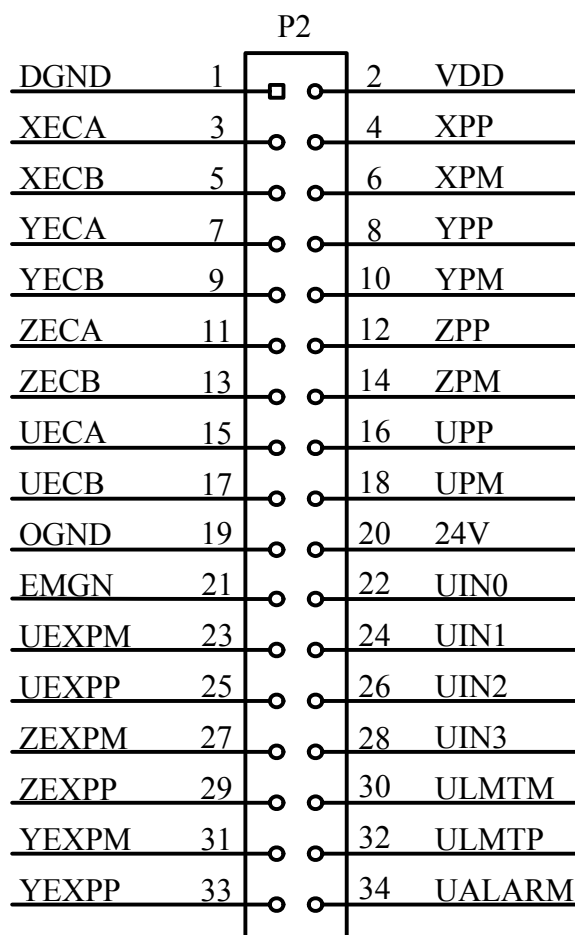
ID5	ID4	ID3	ID2	Physical ID (Hex)
OFF (0)	OFF (0)	OFF (0)	ON (1)	0
OFF (0)	OFF (0)	ON (1)	OFF (0)	1
OFF (0)	ON (1)	OFF (0)	OFF (0)	2
ON (1)	OFF (0)	OFF (0)	OFF (0)	3

# Chapter 3 Pin Layout

## 3.1 Analog Signal Connector



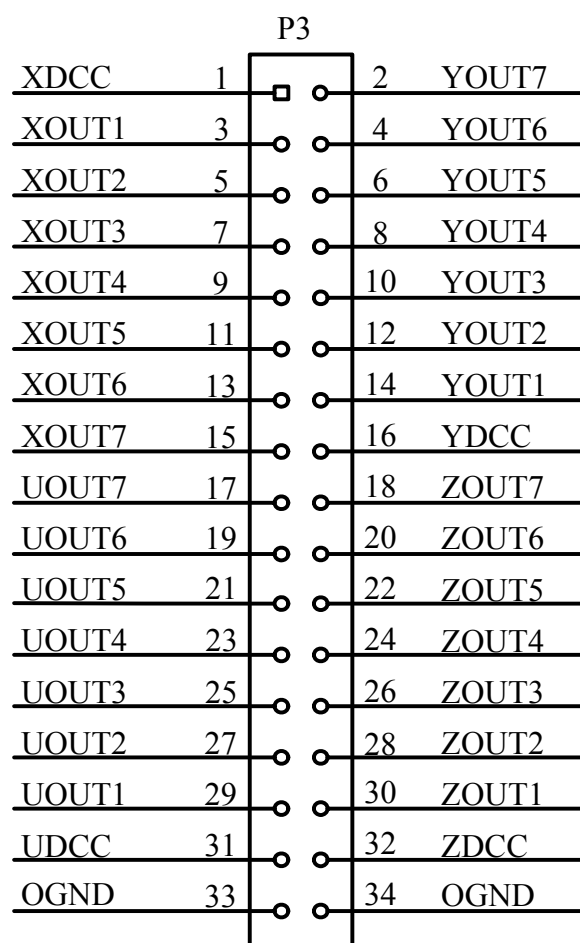
Pin No	Signal Name	Description
22	XINPOS	In-position: input signal for servo driver in-position
4	YINPOS	Enable/disable and logic levels can be set as commands. When “enable” is set, and after the driving is finished, this signal is active and standby.
19	ZINPOS	
2	UINPOS	
24	XALARM	Servo Alarm: input signal for servo driver alarm
8	YALARM	Enable/disable and logical levels can be set as commands.
17	ZALARM	
26	XLMTMP	Over Limit +: signal of + direction over limit
10	YLMTMP	During the + direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active. When the filter function is disabled, the active pulse width must be 2CLK or more.
15	ZLMTMP	
28	XLMTM	Over Limit -: signal of - direction over limit
12	YLMTM	During the - direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active. The active pulse width should be more than 2CLK. Decelerating stop/sudden stop and logical levels can be set during the mode selection.
13	ZLMTM	
27,25,23,21 14,16,18,20 11,9,7,5	XIN3~0 YIN3~0 ZIN3~0	Input 3~0: input signal to perform decelerating/sudden stop for each axis These signals can be used for HOME searching. The active pulse width should be more than 2CLK. Enable/disable and logical levels can be set for IN3~IN0. In automatic home search, IN0, IN1, and IN2 are assigned to a near home search signal, a home signal, and an encoder Z-phase signal respectively.
3	XEXPP	External Operation +: + direction drive starting signal from external source When the fixed pulse driving is command from an external source, +direction driving will start if this signal is down. Otherwise, when the continuous pulse driving is commanded from an external source, + driving will start if this signal is on the low level. In manual pulsar mode, the encoder A-phase signal is input to this pin.
1	XEXPM	External Operation -: - direction drive starting signal from external source When the fixed pulse driving is command from an external source, -direction driving will start if this signal is down. Otherwise, when the continuous pulse driving is commanded from an external source, -driving will start if this signal is on the low level. In manual pulsar mode, the encoder B-phase signal is input to this pin.
6	EXPLS	
29		
30		
31		
32		
33		
34		



Pin No	Signal Name	Description
4	XPP/PLS	Pulse +/pulse: + direction drive pulse driving
8	YPP/PLS	When the reset is on the low level, and while the driving is starting, DTUY 50% (at constant speed) of the pulse are outputting. +or –pulse mode is selectable.
12	ZPP/PLS	
16	UPP/PLS	When the 1-pulse 1-direction mode is selected, this terminal is for drive output.
6	XPM/DIR	Pulse -/pulse: - direction drive pulse driving
10	YPM/DIR	When the reset is on the low level, and while the driving is starting, DTUY 50% (at constant speed) of the pulse are outputting. +or –pulse mode is selectable.
14	ZPM/DIR	
18	UPM/DIR	When the 1-pulse 1-direction mode is selected, this terminal is direction signal.
3	XECA/PPIN	Encoder-A/Pulse +in: signal for encoder phase-A input
7	YECA/PPIN	This input signal, together with phase-B signal, will make the Up/Down pulse transformation to be the input count of real position counter.
11	ZECA/PPIN	When the UP/Down pulse input mode is selected, this terminal is for UP pulses input. Once the input pulse is up, the real position counter is counting up.
15	UECA/PPIN	
5	XECB/PMIN	Encoder-B/Pulse -in: signal for encoder phase-B input
9	YECB/PMIN	This input signal, together with phase-A signal, will make the Up/Down pulse transformation to be the input count of real position counter.
13	ZECB/PMIN	When the UP/Down pulse input mode is selected, this terminal is for UP pulses input. Once the input pulse is up, the real position counter is counting up.
17	UECB/PMIN	
34	UALARM	Servo Alarm: input signal for servo driver alarm Enable/disable and logical levels can be set as commands.

32	ULMTP	Over Limit +: signal of + direction over limit During the + direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active. When the filter function is disabled, the active pulse width must be 2CLK or more.
30	ULMTM	Over Limit -: signal of - direction over limit During the - direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active. The active pulse width should be more than 2CLK. Decelerating stop/sudden stop and logical levels can be set during the mode selection.
28,26,24,22	UIN3~0	Input 3~0: input signal to perform decelerating/sudden stop for each axis These signals can be used for HOME searching. The active pulse width should be more than 2CLK. Enable/disable and logical levels can be set for IN3~IN0. In automatic home search, IN0, IN1, and IN2 are assigned to a near home search signal, a home signal, and an encoder Z-phase signal respectively.
33 29 25	YEXPP ZEXPP UEXPP	External Operation +: + direction drive starting signal from external source When the fixed pulse driving is command from an external source, +direction driving will start if this signal is down. Otherwise, when the continuous pulse driving is commanded from an external source, + driving will start if this signal is on the low level. In manual pulsar mode, the encoder A-phase signal is input to this pin.
31 27 23	YEXPM ZEXPM UEXPM	External Operation -: - direction drive starting signal from external source When the fixed pulse driving is command from an external source, -direction driving will start if this signal is down. Otherwise, when the continuous pulse driving is commanded from an external source, -driving will start if this signal is on the low level. In manual pulsar mode, the encoder B-phase signal is input to this pin.
21	EMGN	Emergency Stop: input signal to perform the emergency stop for all axes When this signal in on the low level, including the interpolation driving, every axis will stop the operation immediately. The low level pulse width should be more than 2CLK. <b>【Note】</b> For this signal, its logical levels cannot be selected.
2	VDD	+ 5V Power Terminal
20	24V	+ 24V Power Terminal
1	DGND	Ground (0V) Terminal
19	OGND	Ground (0V) Terminal of external 24V

## 3.2 General-purpose Signal Output Connector

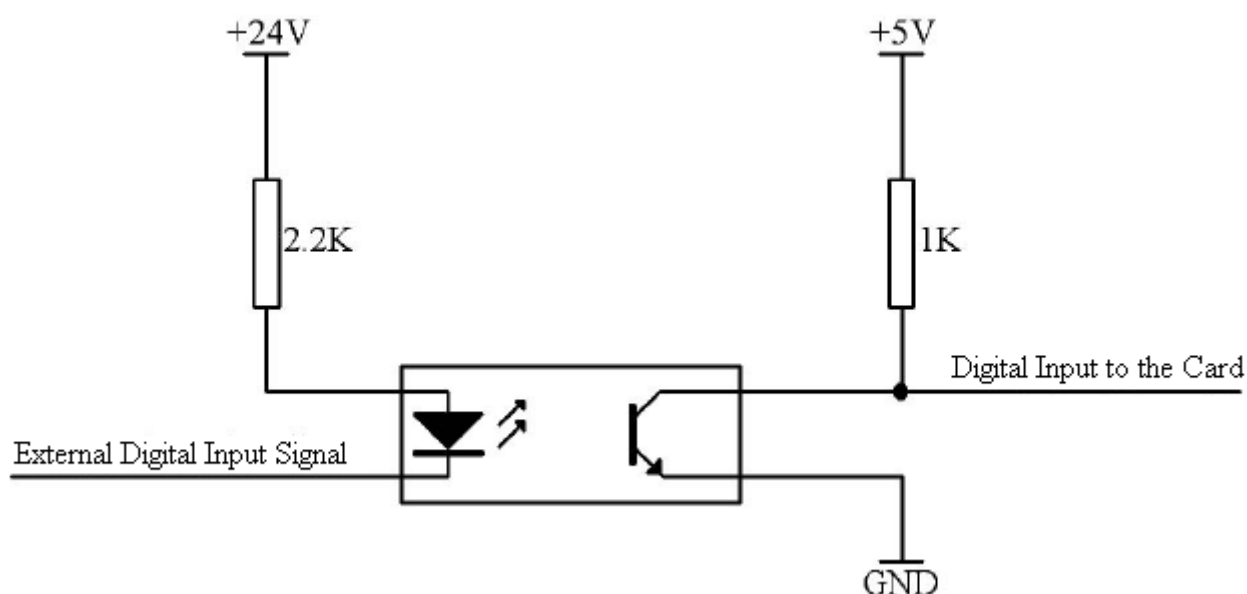


Pin No	Signal Name	Description
1 3 5 7	XDCC XOUT1 XOUT2 XOUT3	X-axis general purpose output
16 14 12 10	YDCC YOUT1 YOUT2 YOUT3	Y-axis general purpose output
32 30 28 26	ZDCC ZOUT1 ZOUT2 ZOUT3	Z-axis general purpose output
31 29 27 25	UDCC UOUT1 UOUT2 UOUT3	U-axis general purpose output
15 2 18 17	XOUT7 YOUT7 ZOUT7 UOUT7	General Output 7/Descend: general purpose output signals When the drive status output mode is engaged, this signal can be used for reflecting the status of deceleration. While the driving command is executed and during the deceleration, it becomes high

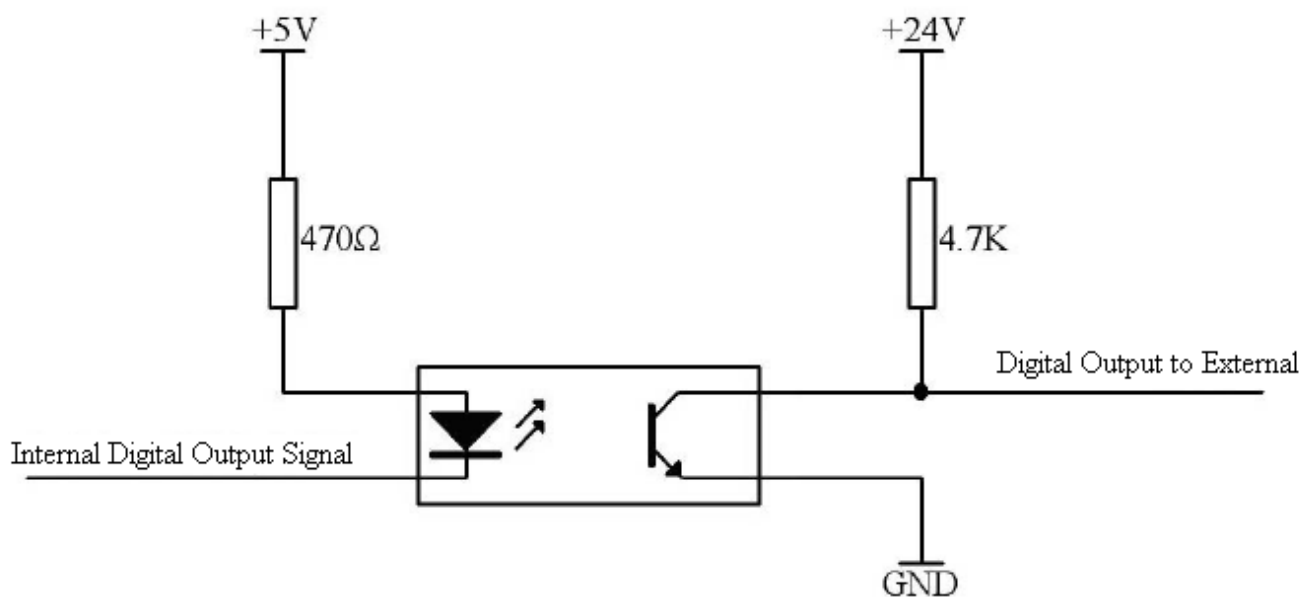
13	XOUT6	General Output 6/Ascend: general purpose output signals
4	YOUT6	When the drive status output mode is engaged, this signal can be used for reflecting the status of acceleration. While the driving command is executed and during the acceleration, it becomes high
20	ZOUT6	
19	UOUT6	
11	XOUT5	General Output 5/Compare-: general purpose output signals
6	YOUT5	When the drive status output mode is engaged, it becomes high if the value of logical/real position counter is smaller than that of COMP-; it becomes low if the value of logical/real position counter is larger than that of COMP-.
22	ZOUT5	
21	UOUT5	
9	XOUT4	General Output 4/Compare+: general purpose output signals
8	YOUT4	When the drive status output mode is engaged, it becomes high if the value of logical/real position counter is larger than that of COMP+; it becomes low if the value of logical/real position counter is smaller than that of COMP+
24	ZOUT4	
23	UOUT4	
33	OGND	Ground (0V) Terminal of external 24V
34	OGND	Ground (0V) Terminal of external 24V

### 3.3 General-purpose Signal Wiring

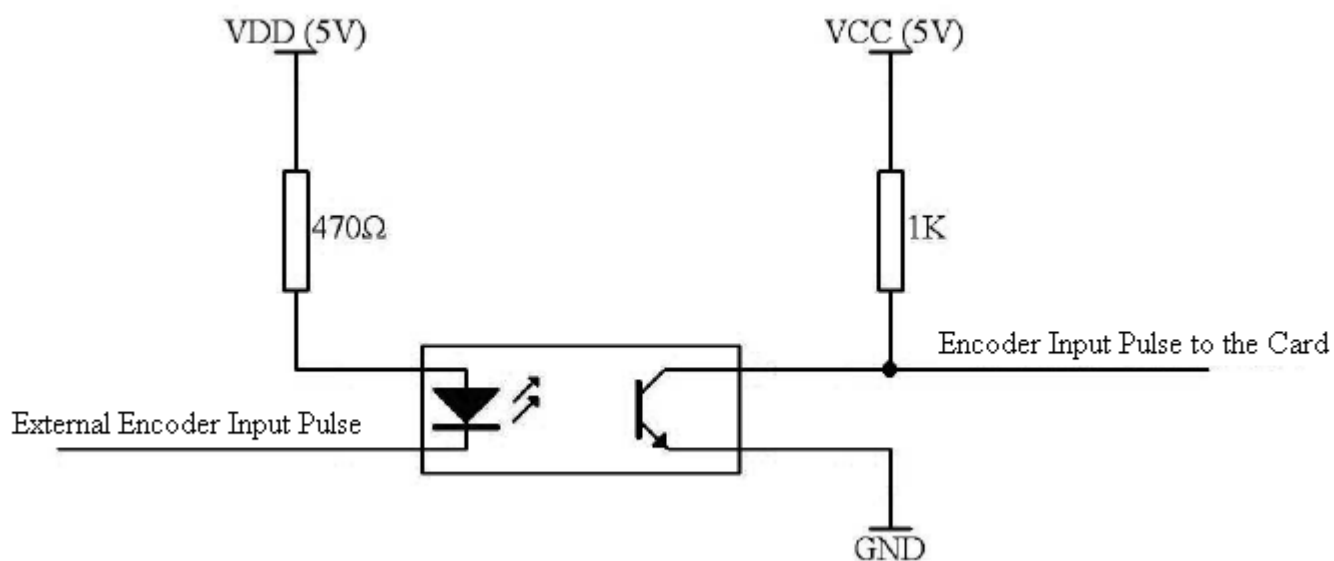
#### 3.2.1 Contact-type Digital Input



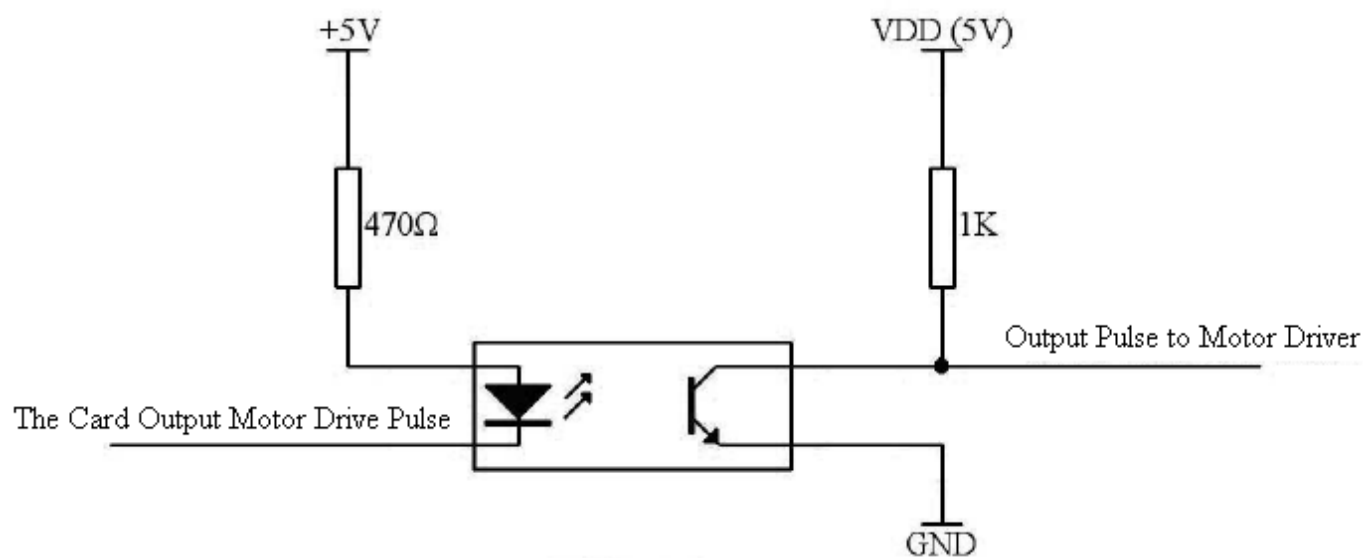
### 3.2.2 Digital Output



### 3.4 Encoder Input Wiring



### 3.5 Motor Control Output Wiring



## ***Chapter 4 Notes, Warranty Policy***

### **4.1 Notes**

In our products' packing, user can find a user manual, a PCH1020 module and a quality guarantee card. Users must keep quality guarantee card carefully, if the products have some problems and need repairing, please send products together with quality guarantee card to ART, we will provide good after-sale service and solve the problem as quickly as we can.

When using PCH1020, in order to prevent the IC (chip) from electrostatic harm, please do not touch IC (chip) in the front panel of PCH1020 module.

### **4.2 Warranty Policy**

Thank you for choosing ART. To understand your rights and enjoy all the after-sales services we offer, please read the following carefully.

1. Before using ART's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: [www.art-control.com](http://www.art-control.com).
2. All ART products come with a limited two-year warranty:
  - The warranty period starts on the day the product is shipped from ART's factory
  - For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ART is not responsible for any loss of data.
  - Please ensure the use of properly licensed software with our systems. ART does not condone the use of pirated software and will not service systems using such software. ART will not be held legally responsible for products shipped with unlicensed software installed by the user.
3. Our repair service is not covered by ART's guarantee in the following situations:
  - Damage caused by not following instructions in the User's Manual.
  - Damage caused by carelessness on the user's part during product transportation.
  - Damage caused by unsuitable storage environments (i.e. high temperatures, high humidity, or volatile chemicals).
  - Damage from improper repair by unauthorized ART technicians.
  - Products with altered and/or damaged serial numbers are not entitled to our service.
4. Customers are responsible for shipping costs to transport damaged products to our company or sales office.
5. To ensure the speed and quality of product repair, please download an RMA application form from our company website.